From *Terra incognita* to Garden of Eden:

Unveiling the prehistoric life of China and Central Asia, 1900-1930

Abstract

In the 1890s, the palaeontological and geological records of China were largely unknown to the major international research networks, centered around Europe and North America. Yet over the following decades, China and Central Asia became the focus for a range of research projects and theoretical interpretations. This chapter examines how this was conducted by a range of figures both within and outside China. In doing so, it interrogates the dynamics of western scientific interaction with China in the early-twentieth century, and how local knowledge was interpreted and interacted with wider global conceptualizations.

Introduction

The history of scientific research and international exchange in modern China is developing as a major area of study, presenting a complex series of circulations between developing institutions and networks in China and their established counterparts in Europe and the United States. In the late-Qing and Republican periods, western scientists increasingly came to study the natural history and geography of China, either as lone naturalists or members of expeditions, using the territory as a field of investigation. Meanwhile, Chinese scientists and scholars attempted to translate foreign knowledge into Chinese idioms, traveled abroad to study and learn techniques, and used their new expertise to build into domestic projects of 'saving China through science and democracy.'[1] 'Field sciences,' such as geology, ethnography, natural history and archaeology, also required a great deal of local knowledge for access and location of material,[2] as well as dialogue and exchange with local informants – often peasants, nomads and miners. This ensured that what was found locally in various regions of China was made to speak on a wider international plane, while depending upon a variety of intermediaries and agents.

The combination of local and external agencies in scientific research led to numerous tensions and negotiations, as Chinese networks and scholars interacted with colonial and internationalist projects, participating in them but also beginning to assert their own authority. The way these processes operated in antiquities protection and geology have recently been studied in penetrating detail by Fa-Ti Fan and Grace Shen, who have both shown the complexity of 'colonial' and 'international' field science within China, and the nationalist and internationalist responses to it by Chinese intellectuals.[3] This chapter continues these studies by focusing more closely at how these processes manifested in one particular field - palaeontology, the study of ancient life, in the first decades of the twentieth century. China presents a notable case-study in this for two primary reasons. Firstly, China and central Asia contain some of the most extensive fossil-bearing deposits in the world, which have been unevenly investigated in different historical periods. The modern history of palaeontology in China is often told as the story of a series of epoch-making discoveries punctuated by long periods of disruption: the unearthing of the Peking Man fossils at Zhoukoudian in the 1920s and 1930s, which revolutionized studies of human evolution before being lost in the chaos of the Second World War;[4] the isolation of Chinese science during the Mao period and Cultural Revolution;[5] and the recent striking discoveries of feathered dinosaurs in north-eastern China.[6] However, in the early decades of the twentieth century, the records of prehistoric life in the region were only slowly investigated. In this period, global and international forces interacted to ascribe meaning to fossil material, interpreting it according to locality, metropolitan contexts and its routes of transmission.

Processes of local exchange and international circulation are particularly notable in palaeontology, as it is a field which depends on transmission and comparison across national and disciplinary boundaries.[7] To reconstruct past ecosystems, environments and animal faunas, fossils needed to be closely contextualized locally in order to ascertain their character and relationships, but then positioned much more widely within the global and chronological scope of the entire history of life. Palaeontology also requires cooperation between a range of scientific disciplines, including evolutionary biology, geology, natural history and archaeology – subjects with varying forms of local, national and international institutionalization. Yet additionally, the unearthing and extraction of fossil material required skills tied to local contexts: knowing and locating fossil-bearing rock strata required deep knowledge of particular localities; unearthing the often fragile remains depended on technical skill and training in field excavation and preservation; and before the material could be interpreted, it needed to be fully extracted and prepared, which required laboratory work and extensive equipment. In this way, hierarchies were built into palaeontological study – material was unearthed in particular regions using local knowledge, but then sent to authoritative centers to be interpreted. As such, the discipline rested on hierarchies of transmission.

This paper examines three examples of early palaeontological research where these elements flowed together, but operated in distinct manners: firstly, it examines the 'dragon bones' purchased by H. A. Haberer in various treaty ports in 1899-1901, and sent to Munich to be studied by Maximillian Schlosser; it then moves on to the theories of the ancient history of mammalian (and particularly primate) life put forward by Davidson Black, a scholar associated with the Geological Society of China in the mid-1920s; and finally, the problematic attempts by Marcellin Boule in France and Henry Fairfield Osborn in the United States to integrate the results of two major research expeditions in China and Mongolia into their global evolutionary studies. In some ways, these projects reflect expansion over the early twentieth century, but in others, they show the fraught development of palaeontology both in China and internationally. In each cases, the records of prehistoric life in China and Central Asia were not only seen to fill important gaps in the history of the earth's life and climate, but became an important means of connecting knowledge and institutions across international boundaries and scholarly communities.

Dragon Bones: From Shanghai to Munich

The early development of palaeontology in China depended on the interaction of two deeply-held – although quite distinct – mythic ideas. The first was local to China. While China's fossils were 'unknown to science' in the early twentieth century, they were far from unknown to local systems of knowledge. There was a long tradition in Chinese medicine of regarding fossil bones and teeth as 'dragon bones' [*Lung ko*] and 'dragon teeth' [*Lung chi*]. Documented in a variety of works from the 1st century AD onwards, these were ascribed the ability to cure a range of ailments – including dysentery and impotence – when ground into powder and ingested.[8] Generally, these were the teeth and bones of Pleistocene mammals: the remains of elephants and rhinoceroses gave black dragon bones; while those of smaller animals, such as the three-toed early horse *Hipparion*, were the more valuable white dragon bones. The collection of these was far from a small-scale or peripheral endeavour, with productive sites seeing large-scale mining operations, with material excavated through considerable expertise. Excavated bones and teeth were then transported by traders and merchants to urban apothecary stores, and often exported to Chinese communities abroad. The scale of the trade was large: in 1884-1885, the Chinese Imperial Maritime Customs listed 350 piculs (20,000 kilograms) of dragon bones and teeth being exported.[9]

If the mining of dragon bones was a commercial affair within China, western conceptions of Asian fossil life were rather more abstract. There was major interest in the possibility that central Asia was the original site of the evolutionary development of a range of important organisms – particularly mammals, and potentially also humans. This theory grew from a combination of contemporary scientific ideas and very deep and long-standing notions. Biblical traditions presented the world as having been populated through migrations of both humans and animals from a centre of divine creation in inner Asia.[10] By the later nineteenth and early-twentieth century, this idea persisted, but was refracted through contemporary scientific notions. In a period before the wide acceptance of plate tectonics and continental drift, there was a pressing need to explain the wide dispersal of fossil and modern animals. This led to notions of 'centers of dispersal' – that animal families had originated in particular regions, and then spread to dominate new areas and displace earlier types. Central Asia was often cited as a crucial region of dispersal, being located between the well-studied (and zoologically related) regions of Europe and North America, and therefore seen as at the very centre of the distribution of life. The idea of central Asia as an evolutionary crucible also corresponded to contemporary evolutionary ideas, which often held that harsh steppe environments were best suited to the development of dynamic, migratory and progressive species, while those in tropical regions would invariably degenerate or become over-specialized monstrosities. As such, even before systematic palaeontological research was conducted in Asia, China – as one of the easiest entry points to the central Asian interior – was very much in the minds of western scholars as a vital area of study.

As well as these grand theories, local interaction was critically important for the gathering of material, particularly through networks in and around China's treaty ports. This is shown in the first researcher to be investigated in this chapter, Karl Albert Haberer, a German doctor who visited China in 1899. Haberer attempted to follow the tradition of western naturalists penetrating the Chinese interior to gather specimens and survey potentially interesting regions. This course had been followed both by British and French naturalists earlier in the century, and also by Haberer's own countryman, the renowned geologist Ferdinand von Richthofen in the 1870s and 1880s.[11] However, Haberer recalled how the 'military events of the summer of 1900 … brought my researches to an abrupt halt.'[12] Blocked from traveling inland by the Boxer uprising, he instead made a tour of the apothecary shops of the treaty ports, purchasing a large collection of 'dragon bones.' He presented this in terms of rescuing important scientific material from the chaos of Chinese business practices:

> I found the greatest sources of these fossils in Shanghai – not in the apothecaries ... which although very luxuriously put together, only yield a few mostly broken pieces and charge very expensive prices for them, but in the nondescript ends of large drug traders, as I only really found in Shanghai. These are found in great numbers (around 50) in the truly Chinese districts, in

> narrow Chinese-style thatched-roofed alleyways, quite far apart from European trade.
>
> The material itself is sewn up in straw mats into round bales, which are bound with ropes. White and black *lung chi* are specially packaged and carefully divided. In order to investigate them, the bales were poured into a shallow basket and searched carefully, because the material is mixed with a quantity of small stones, bone fragments and bits of earth. In particular the *lung chi* are mixed up with plenty of recent teeth of horses, buffalo and so forth, so that picking out the most valuable fossil material must be left to the experts. This mixing of the *lung chi* with recent teeth is clearly intended to deceive the public, because only heavily mineralized fossils have medicinal value in the eyes of the Chinese.
>
> As a result, my thorough searching through the chaos of stones, bones, fossils and recent skeletal material was met with some resistance from the Chinese traders, and I usually had to pay a very high price, or else the business fell through entirely, and my laboriously sorted fossils were taken back.[13]

Haberer presented his collecting practices as the European scholar bringing order, knowledge and correct typological organization to a disorientated and confused native field – even if he was often foiled by Chinese business practices. He also presented it as a German project. He expressly thanked his 'countrymen' in his report, in particular the German General Consul in Canton Dr. Wilhelm Knappe, and a variety of German customs officials, military officers and engineers. The only non-German was ‘Sir Robert Hart,’ the British Inspector General of the Imperial Maritime Custom Service service, ‘whom I thank for an extremely valuable correspondence regarding the fossils.’[14]

While Haberer used his local access as best he could, he was not able to study the material himself. For this, a metropolitan authority was required, not only for reasons of training and prestige, but also because of the need for classification through comparison. In order to be identified, the Chinese fossils needed to be compared to similar specimens found elsewhere in the world – something which required a large and varied fossil collection. As a result, Haberer’s material was sent back to Germany as a donation to Maximillian Schlosser, a Munich based expert in fossil mammals with access to large natural history and palaeontological collections. Schlosser received the material, and published the results of his studies in the Reports of the Royal Bavarian Academy of Sciences. Schlosser’s studies also worked within a national context: while he highlighted the (quite limited) history of research into the palaeontology of eastern Asia, he corresponded on the matter with other German authorities. On studying the material, Schlosser concluded that Haberer’s collection was very diverse, containing the remains of over 80 different kinds of animals. This quintupled the amount of species known from Chinese prehistory, and included various forms of elephant and mastodon, modern and primitive rhinoceroses, antelopes, deer, bears, hyena and horses. Most numerous by far was an early equid, *Hipparion richthofeni*, which was represented by 670 teeth.[15] This species had earlier been discovered by Richthofen’s palaeontologist Ernst Koken in the 1880s, and similar forms were found in Europe and north America. These relationships suggested that ancestral horses had inhabited the whole of the northern hemisphere in the depths of prehistory. Comparisons of the rest of the remains with the better documented fauna of North America, western Asia, Indonesia, South Asia and Europe led Schlosser to wider conclusions that the northern hemisphere had been the origin point of even more animals. Anatomical similarities and relationships implied that several families, such as rhinoceroses and hyenas, 'which have been taken as principally characteristic of the "Ethiopian region," in reality originated in Asia.'[16] This again centered the origins of life at some Asian point of dispersal, in ancient geological eras.

However, while the material was extensive, it was also problematic. Most of the specimens were broken and fragmentary pieces – something which should be unsurprising, as Chinese medicine only utilized individual teeth and bones rather than entire skeletons. The methods of excavating the remains also left much to be desired in the western scientific mind. In palaeontology and related sciences, precise knowledge of locality and context were absolutely crucial for dating specimens. However, Schlosser noted that 'regarding the sources of the Chinese animal remains we only have the imprecise instructions of the apothecaries, with only vague notices of Yunnan, Sichuan, Shaanshi and Honan.'[17] While the animals could be compared with those from other parts of the northern hemisphere to place them within relatively recent geological periods, it was impossible to identify which part of China the material had come from, what exact geological strata they had been located in, or which remains were associated with one another.

Schlosser's researches therefore seemed to demonstrate that inner China and central Asia were important palaeontological areas, where large numbers of specimens could be found. However, Schlosser continued to note that 'as long as we only know the Chinese mammalian material from isolated teeth, we will in most cases remain limited to conjecture in our establishment of genetic relationships'[18] The implication was that this important research needed to be conducted by Europeans with the correct scientific training and principles. Framed as a colonial project, in which Chinese material needed to be rescued from the commercialized chaos of its original excavation and interpreted through western expertise, this posited definite hierarchies and power relations between different regions, forms of knowledge and principles of organization. However, it also presented China as a land of opportunity to trace life's early development. This was particularly striking in the light of one specimen found in Haberer's collection: a primate molar tooth from the lower Pleistocene. This raised the implication that primates and even humans had possibly developed in inner Asia, and meant that for Schlosser 'the aim of this piece is that future researchers … conducting excavations in China may be made aware that there they may be able to find either new fossil anthropoids, or tertiary humans or old Pleistocene humans.'[19]

The Geological Society of China and the Dispersal of Primates from Asia

The early decades of the twentieth century saw considerable shifts in research and interest in China and its fossil records. The extensive German networks in China of the

1890s and 1900s, which Haberer had been able to take advantage of, were broken up by the First World War, which cut German scholars out of China, as well as wider colonial and international networks. However, this period also saw an expansion of Chinese institutions. Chinese scholars trained in field sciences, especially geology, became highly active and increasingly organized, and presented scientific work, political change and social reform as corollaries of the same project of national revival.[20] The most prominent of these organizations – the Chinese Geological Survey of 1914 and the Geological Society of China of 1923 – were among the first scientific institutions to be funded by the Republican state and also to consist primarily of Chinese scholars. Palaeontology, a natural accompaniment of geological work, also gained much attention and became an important focus for both international cooperation and local excavation.

These institutions represented a mix of the international and national. Most of the first generation of Chinese geologists were educated abroad: Ding Wengxiang, the Geological Survey's first director, studied in Glasgow; Wong Wenghao, the second director, was educated in Louvain in Belgium; and the palaeontologist Yang Zhongjian studied for his doctorate in Munich under Schlosser in the 1920s. The international character of the Geological Society can also be seen in its membership and exchange networks: at its first meeting, the society's secretary C. Y. Hsieh noted that 'this Society is really quite a cosmopolitan one. Among our foreign members, there are ten Americans, five Swedes, three natives each of Russia, France and Great Britain, two Japanese, and one native each of Belgium, Czecho-Slovakia, and Austria.'[21]

As well as awarding corresponding memberships to major international figures (an important means of network building), the Chinese geological community also incorporated a large number of expatriates, who often filled gaps where Chinese scholars lacked the requisite skills. Initially, they had taken advantage of the German presence in China, and a German scholar named Friedrich Solger was hired to train Chinese geologists in 1910, although he left at the outbreak of war.[22] Following this, wider connections were taken up: a Swedish geologist, Johan Gunnar Andersson, was hired as a geological expert in 1914, and brought extensive interests and connections in archaeology and palaeontology; Amadeus Grabau, an American geologist of German origin, who had been forced out of his Professorship at Colombia University in 1918 over apparent German sympathies, was also hired as Professor of Geology at Peking University to train new generations of Chinese scholars; and Davidson Black, a Canadian anatomist attached to the Rockefeller Foundation-funded Peking Union Medical College, became the local expert on human and primate study.

This coalescence of expertise around Peking in the 1920s is primarily remembered for its role in the excavation and publicization of the Peking Man fossils from 1926 onwards. However, prior to this global sensation, it is important to remember that the Chinese geological community's international connections were often tentative, problematic and small-scale. In particular, Grace Shen has drawn attention to the problems faced by Chinese scholars participating in international geological congresses, and how building into international networks of scholars was often as much a forced necessity as it was a mark of global acceptance.[23] Similar issues also impacted upon work on fossils. Fossil material was continually discovered in the early years of Chinese geological research, although was often quite small scale. Geological workers tended to operate in regions of north-eastern China where Palaeozoic and Pleistocene rock strata were most common, and so Ice age mammals were commonly discussed, as well as large numbers of brachiopods and other ancient invertebrates. While much of this material was discovered in the course of regular geological surveying, members of the Geological Society also conducted some dedicated palaeontological researches. Johann Gunnar Andersson for example followed reports from missionary stations and Chinese apothecary shops on dragon-bone sites, and then hired local workers who were experienced in unearthing them for medicinal purposes.[24] In the upper echelons of the societies, crediting ancient Chinese knowledge with important insights into fossil life also served as an important framing device for the current upsurge of Chinese research into geology and palaeontology. H. T. Chang highlighted how:

> An author of the Tang dynasy, Yen Cheng-ching, in his desciption of the temple of Maku at Fuchou, spoke of the secular changes of the sea and the land, because he correctly recognized the bracyiopod fossils that occur nearby, as marine animal remains. The famous scholar Chu Hsi of the Sung dynasty says, ‘bivalves are often found on high mountains sometimes occurring in solid rock. This rock must have been the soil of ancient days and these bivalves must have lived in water. Thus low ground becomes high and soft earth becomes hard rock.’ Chu Hsi therefore had even correctly interpreted the origin of sedimentary rocks! It is to be noted that both these authors are famous for their

> moral rectitude which is perhaps the common characteristics of the modern palaeontologists.
>
> These strains of thought were doubtlessly unorganized and fragmentary and lack the sureness and consistency of modern scientific knowledge. Nevertheless we cannot help thinking that they were true germs of the science of geology. If we now graft onto this ancient stock the beautiful flowers from foreign countries they will doubtless bear good fruit.[25]

In this, scientific development could be based on the integration of traditional Chinese and foreign learning. The need to overcome traditional obscurantism, or at best take advantage of what in the Chinese tradition was confluent with modern science, became an important feature of this research and its justification.

However, as with Schlosser's work, in order for the Chinese material to be adequately interpreted, it could not remain in China. It needed to be contextualized alongside better known North American and European material, and the collections of Asian, Indonesian and African material in European and American museums. Negotiations with large institutions in France and the USA for exchanges of material came to nothing. This seems to have been partly due to skepticism from many European and American scholars at the abilities of Chinese scientists to conduct adequate research, especially in the light of the relatively unimpressive mollusks and fragmentary teeth and antlers which were coming out of China. However, the Chinese societies could still take advantage of connections being forged on the ground. Material was instead sent to Sweden, following the links established by Andersson with the University of Uppsala, where Carl Wiman, a renowned palaeontologist, agreed to study and analyze Chinese material as it was sent to him.

Despite these difficulties in building international links and connections, attempts were made by the scholars in China to present theories of global importance. This tended to focus on relatively recent geological eras, but aimed to speak on themes which would appeal to much wider international audiences, particularly on such topics as the search for the origins of human and mammal life. One of the most significant was Davidson Black's article in the *Bulletin of the Geological Society of China* entitled 'Asia and the Dispersal of the Primates,' published in 1925. This very much served as the synthesis and manifesto justifying the importance of palaeontological research in China. Black mixed together theoretical principles developed in other countries, local knowledge of Chinese geology and palaeontology, and the new geological models being developed by other Geological Society members. This is shown in some of Black's major influences. He depended a great deal on Amadeus Grabau's theories of the development of the earth, which presented an early and rather idiosyncratic model of continental drift, and supplied a series of maps of the ancient prehistoric world onto which the movement of species and organisms could be plotted.[26] However, he also used an influential American work, the 'masterly treatise on 'Climate and Evolution'[27] by William Diller Matthew, which saw all major mammalian groups as originating from centers of dispersal in the northern hemisphere, before being driven out across world through oscillating moist and arid climatic conditions.[28]

Black's core argument was that when these theories and the Chinese fossil evidence were linked with studies of primate evolution in Africa, the Americas and Asia, they indicated that the original centre of development for the primates was the ancient continent of 'Pal-Asia,' whose relics were now to be found in central Asia and western China. While rather tentative on the mechanisms of evolution, Black started with the basic axiom which was inherent in theories of centers of dispersal:

> Whatever agencies my be assigned as the cause of evolution in a race, it should be at first most progressive at its point of original dispersal, and it will continue this progress at that point in response to whatever stimulus originally caused it and spread out in successive waves of migration each wave a stage higher than the previous one. At any one time, therefore, the most advanced stages should be nearest the centre of dispersal, the most conservative stages farthest from it.[29]

Black followed through the analysis by arranging all the primate groups into a hierarchy of ascending development, from Prosimians (such as lemurs and tarsiers), New World monkeys, Old World monkeys, anthropoid apes and finally up to humans. These were all (with the exception of the New World monkeys) presented as having originally developed in Pal-Asia and then spread out across the world. This could be made fairly convincing in the case of Prosimians through local discoveries, presenting Andersson's discoveries of 'lemuroid insectivore fossil types from the Eocene of southern Shansi.'[30] However, these creatures had apparently died out in Palasia over the following geological epochs, to survive only in more distant such as southern Africa, Madagascar and south-east Asia. Moving up the scale of development, the New World and Old World monkeys were presented as parallel and independent developments from common prosimian ancestors. With regard to apes, Black highlighted the dispersal of modern anthropoid apes between Chimpanzees and Gorillas in Africa, and gibbons and orang-utans in Asia. This seemed to demonstrate that ‘at some time during the Younger Tertiary the ancestors of the large anthropoids existed in some region intermediate between the present Oriental and African areas occupied by their modern descendants; and that the intermediate region then inhabited was not far removed from their dispersal centre’[31] – again marking out Asia as the most likely area for their original evolution. Finally, humans were presented as developing separately from the anthropoid apes, but again followed the same principles:

> during some epoch of the Tertiary within a relatively restricted area, the first primitive members of the genus Homo became differentiated as the culminating contemporary response to whatever stimuli have caused the progressive evolution of the Anthropoidea. On this hypothesis also, the further evolution of the genus should continue most rapidly within its original dispersal area, from which successive waves of migration would spread, each wave a stage higher than the previous one.[32]

Their most likely centre of dispersal was also placed in Asia, owing to the distribution of the then discovered hominins, particularly Pithecanthropus in Indonesia, and Heidelberg and Neanderthal man in Europe. This again staked out Asia and China as key areas in which to search for human ancestors.

Therefore, through this synthesis of material, publications and new interpretations, China could be highlighted as the best region to search for the origin of not only primates in general, but also the evolutionary history of humans. The implications were potentially vast, as it made research into the ancient life of Asia critical to understand human evolution, and reinforced ideas of Asia's potential status as the palaeontological 'Garden of Eden.' These assertions also made the geological theories and researches being undertaken in China important on an international level: the maps used by Davidson Black were not the static ones favoured by many authorities, but the dynamic and shifting ones developed by Grabau, and this was crucial to the environmental forces that conditioned the evolution of the primates and their migrations. As a result, China was not only presented as a vital place for the unearthing of fossil remains, but also a place where new theories and principles were being developed. In this way, articles such as Black's were a manifestation of the growing independence and confidence of Chinese geological research being undertaken (albeit by expatriate scholars) in China.

Metropolitan Authorities and Asiatic Expeditions

It was not only developments in China which presented Asian palaeontology as being of wide significance. By the 1920s, major European and American authorities were also taking up the agenda presented in Schlosser and Black's works, for large, well-funded expeditions into inner Asia (traveling via China) to study the origins of animal life in general, and potentially also human life. Two figures were particularly important: Henry Fairfield Osborn, President of the American Museum of Natural History in New York, an imperious figure who dominated American palaeontology in the early-twentieth century; and Marcellin Boule at the Muséum d'histoire naturelle in Paris, one of the leaders of European palaeontology and human evolutionary studies. Both firmly worked within the 'mythic' implications of their researches. Osborn wrote a self-defined 'prophetic Vision,' in which he integrated two major ideas: of Asia being at the centre of dispersal for European, African and North American animals; and that the development of life depended on deep, teleological processes of specialization and progress. Boule meanwhile expressly wrote:

> In all times, Asia, distant and mysterious, has seduced the imagination of thinkers, poets and scholars … [whether] it has played the principle role in the peopling of our world and particularly in the origin, the dispersion and the evolution, both moral and physical of human groups … this problem can perhaps only be resolved by the methods of geology and palaeontology[33]

In this way again, science was presented as continuing, but also systemizing, older traditions.

These metropolitan authorities however drove a new style of research. While Schlosser had relied on a single collection and Black used a synthesis of already excavated remains, Boule and Osborn went to gather new material through specially organized expeditions. However, these operated on rather different scales. The Central Asiatic Expeditions of the American Museum of Natural History ran from 1921-1930, and were among the largest scientific research projects of the interwar period, costing over $600,000 (raised by big name philanthropy and public subscription), and undertaken by a team of American scientists with Mongolian and Chinese assistance. They unearthed a vast range of specimens from a variety of geological periods, including dinosaurs and dinosaur eggs, large prehistoric mammals such as titanotheres, and Stone Age human artefacts. The *Mission paléontologique française* meanwhile were rather more restrained, costing 69,000 francs (about $6,0000 in total) and consisting of two Jesuits, Emile Licent and Pierre Teilhard de Chardin, visiting a series of Pleistocene sites in the Ordos desert in inner Mongolia between 1921 and 1928. Reflecting the differences in funding, equipment and scale, the French discoveries were also rather more low-key, consisting primarily of antelopes, bison, rhinoceroses, and egg-shells of ancient ostriches, and also more Stone Age tools.

Despite the differences in scope and scale, these two expeditions still followed similar patterns. In both cases, local cooperation was crucial, both in the field and in the transfer of the material. Both were also based in large Chinese cities. The Central Asiatic Expeditions directed from a Peking compound and developing Chinese-staffed laboratory support. The *Mission paléontologique française* meanwhile was supported from Emile

Licent's pre-existing base in Tianjin, where he was building a personal museum of natural history. In this way, the existing networks of European extra-territorial penetration were utilized for scientific research. The field research itself was pursued in line with local dynamics, with discussions with local populations and work with missionaries and traders being crucial for the location of sites. The reports of the Central Asiatic Expeditions are littered with notices received from Mongol nomads and Chinese peasants that particular areas featured 'giant bones' in the landscape or dragon bone sites to excavate. While this certainly reinforced a romantic image of a wild and superstitious country, it is also clear that this was of vital importance to the finding of material. Similarly, the Mission paléontologique française not only used local knowledge to find sites, but also relied on Mongol converts to assist in the excavation, and used the networks of Jesuit stations around inner Mongolia as a ready set of field bases.

The results of these expeditions were also interpreted in similar manners. While both failed in the key goal of discovering early human evolutionary ancestors (although both did discover later human artefacts from the Old Stone Age), they still unearthed a range of creatures with clear similarities to forms found elsewhere in the northern hemisphere. The *Mission paléontologique française* discovered rhinoceroses, bison and antelopes which seemed to be related to forms found in prehistoric Europe. Boule wrote that this meant northern Eurasia could be seen as a single environmental zone:

> Many of these species are well known to European palaeontologists; they allow, better than the others, to establish synchronisms and … of showing

> that the fauna of the Chinese loess was contemporary to that of the European. The resemblances are so great as possible, if one takes account of the enormous distances (around 8000 kilometers) which separate the basin of Paris from the Ordos. We find here, in fact, the *Rhinoceros tichorinus,* true horses, great deer of the red deer and *Megaceros* types, great primitive cattle, our wolf and our cave hyena.
>
> The differences which can be observed are due principally to conditions of a geographical and a climatic order. The mammoth is still unknown to the south of the chain of mountains which separate Siberia from the great Gobi desert; it is replaced her by a southern species, the *Elephas namadicus*.'[34]

Additionally, the diverse animals showed that the Ordos – now a desert – was much more habitable in former geological periods:

> at the time when Palaeolithic man lived in this country, we must imagine that the Ordos was desert enough to give sustenance to the gazelles and rodents of the steppes, but verdant enough equally to nourish, in the vicinity of its dunes, great herbivores. Thus the climate must have been less harsh and at the same time slightly less hot, to satisfy simultaneously the ostrich, buffalo and woolly rhinoceros. And these conditions must have been found not only in a privileged oasis, but over a great part of the Sino-Mongolian plateau: for the *Rhinoceros tichorhinus* and the buffalo are found together from the Ordos to Lake Baikal.[35]

The region, and the changes it was seen to have undergone, were used to make much wider points relating to the pulse of world climate and evolutionary development. These had been driven from inner Asia, and studying this territory provided the key to understanding the origins and dispersal of the main modern branches of life.

The American Central Asiatic Expeditions meanwhile reinforced the idea that Asia was not only the centre of dispersal for recent life, but also for life stretching even deeper into the past. As well as discovering primitive horses and rhinoceroses, they also located much earlier mammals: gigantic titanotheres which seemed to be related to those which Osborn had written voluminously on in the American context; and small mammals from the Cretaceous, 'so exceedingly primitive that their relationship probably will be obscure,' which 'means that we are digging at the very deepest roots of the mammalian family tree.'[36] However, while the mammal skulls were presented by the scientists as of crucial importance, public presentations tended to focus on the dinosaur remains – which were also presented as conforming to the idea of Asia as the cradle of life. A small herbivorous dinosaur from the early Cretaceous, interpreted as the layer of the famous eggs discovered by the expeditions, was named *Protoceratops*, and cited as the 'real ancestor of the great Triceratops'[37] of North America. This was presented as engaging in conflict with bipedal carnivorous dinosaurs which, while small, were in the same family as 'the tyrannosaurus … the most terrible engine of destruction which the earth has ever seen'[38] – a creature which Osborn had in fact named and catapulted to scientific celebrity two decades previously. Osborn would write:

> There can be no question, from our discoveries already made, that Central Asia was the chief theatre of evolution, not only of the land Mammalia, but of the giant land Reptilia of the world. This land evolution took place chiefly among those reptiles which, from their great size, are known as dinosaurs or giant saurians, and this reptilian society soon divided into two chief classes.
>
> The two-fold division of land dinosaur life started in a very modest way in the ancient continent which now makes the roof of the world. Defensive herbivorous types were of relatively small size and their defensive horns or armature were not very well developed. Similarly the offensive, flesh-eating types were of moderate size and power, capable of capturing all the small, herbivorous prey. Step by step, like the evolution of the modern armored battle-ship and the long-range, high-powered projectile, the herbivorous deinosaurs became larger and more stoutly defended, while their carnivorous enemies became more powerful and diversified.'[39]

These similarities and lines of descent were important for presenting Asia as the home of life, and allowed a vision of evolution based on migration and struggle.

An important point is that in both the French and the American expeditions, the right to interpret specimens was reserved for the metropolitan authority, who received the material, placed it within a comparative series and judged its significance for the development of life on earth. While this would seem to provide a clear example of

European and American authority subsuming local research, and channeling and monopolizing important discoveries, the termination of both the Central Asiatic Expeditions and *Mission paléontologique française* demonstrate how crucial local agency was becoming. The Central Asiatic Expeditions were ejected in the course of the political changes in China from 1928 onwards, when its specimens were impounded and new Chinese heritage organizations insisting that the expeditions take Chinese scientists and donate more specimens to Chinese collections. This proved unacceptable to Osborn, who decried these demands in the language of scientific internationalism, as 'a very serious setback to the cause of science and of civilization' and threatened to place China 'in the column of backward, reactionary and non-progressive nations.'[40] Similarly, the *Mission paléontologique française* also collapsed in the late 1920s, although through personal disputes, as Licent became incensed at simply being listed as a 'collaborator' in the expedition rather than a co-director in the official publication. Again, the local networks and actors – in this case missionary rather than tied to the Chinese state – were critical, and the power of the metropolitan authority could be easily cut away, however confident they were of their grand theories.

Conclusion

The history of palaeontological research in early-twentieth China illustrates the complex relations between the local, national, commercial, international and metropolitan aspects of scientific work in the early-twentieth century. The discipline required the interaction of scholars and institutions from a range of backgrounds and places, and material and interpretative authority shifted accordingly. Not only was cross-cultural interaction crucial in these processes – such as in the use of knowledge of ‘dragon bones’ and in locating particular sites – but the relative balance of power and authority altered, moving from commentary by western explorers and experts to a much more proactive and independent stance by scientists in China. While these were still often western expatriates, like Licent and Black, they still operated within an expanding Chinese scientific sphere, and were active in asserting and presenting the global importance of work being undertaken in Asia. This ensured that even though western metropolitan authorities remained crucial for recognition, interpretation and comparison of material, their dominant position was increasingly contested in other regions.

Additionally, discoveries in China were continuously worked into wider notions and controversies of the global development of life’s history. This was partly because China was a developing field of study for palaeontological disciplines, which were slowly increasing their research into non-European territories in this period, but also because of the importance of China and Asia within the pre-existing theoretical models of the development of mammal, human and dinosaur life. This not only provided the spur for research in China, but also allowed those working on the ground in China to claim a much greater importance. As central Asia in particular was staked out as a crucial region for scholarly research in the evolutionary sciences, developing geological and palaeontological authorities could claim increasing importance. In some respects, this acted as a semi-colonial expansion, but it also set the ground for an increase in the prominence of scientists in the territory.

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[1] See F.T. Fan, 'Redrawing the Map: Science in Twentieth-Century China,' *Isis*, 2007, vol. 98, pp. 524-538, *British Naturalists in Qing China: Science, Empire, and Cultural Encounter*, Cambridge, MA: Harvard University Press, 2004) and 'Science and Informal Empire: Victorian Naturalists in China,' *British Journal for the History of Science* 36 (2003) pp. 1-26; Z. Wang, 'Saving China through Science: The Science Society of China, Scientific Nationalism, and Civil Society in Republican China,' *Osiris*, 2002, vol. 17 (2002) pp. 291-322 and L. Schneider, *Biology and Revolution in Twentieth-Century China*, Lanham, MD: Rowman & Littlefield Publishers, 2003.

[2] On the 'field sciences' in a historical perspective, see in particular R. Kohler, *Landscapes and Labscapes: Exploring the Lab-Field Border in Biology*, Chicago: University of Chicago Press, 2002, and H. Kuklick, 'Personal Equations: Reflections on the History of Fieldwork, with Special Reference to Sociocultural Anthropology,' *Isis* 102, 1 (2011): 1–33 and the essays in R. Kohler and H. Kuklick (eds.), *Osiris 11: Science in the Field*, University of Chicago Press: Chicago (1996).

[3] F.T. Fan, 'Circulating Material Objects: The International Controversy Over Antiquities and Fossils in Twentieth-Century China,' in B.V. Lightman, G. McOuat, and L. Stewart, (eds.), *The Circulation of Knowledge Between Britain, India, and China: The Early-Modern World to the Twentieth Century*, Leiden: Brill (2013), pp. 209-236 and Grace Yen Shen, 'Going with the Flow: Chinese Geology, International Scientific Meetings and Knowledge Circulation,' in Lightman, McOuat, and Stewart, (eds.), *Circulation of*

Knowledge, pp. 237-260, and more widely, Shen, *Unearthing the Nation: Modern Geology and Nationalism in Republican China* (Chicago: University of Chicago Press, 2014).

[4] For the Peking Man fossils and their later discussion, see N.T. Boaz and R.L. Ciochon, *Dragon Bone Hill: An Ice-Age Saga of Homo erectus*, Oxford: Oxford University Press, 2004, and H.L. Shapiro, *Peking Man*, London: Touchstone, 1974, L. Jia and W. Huang, *The Story of Peking Man: From Archaeology to Mystery*, Beijing and Oxford: Oxford University Press, 1990, and S. Schmalzer, *The People's Peking Man: Popular Science and Human Identity in Twentieth-Century China*, Chicago: University of Chicago Press, 2008.

[5] This is discussed in W. W. Howells and P. J. Tsuchitani (eds.), *Palaeoanthropology in the People's Republic of China: A Trip Report of the American Palaeoanthropology Delegation*, Washington, DC: National Academy of Sciences, 1977. Schmalzer, *People's Peking Man*, pp. 137-173, however makes a strong argument for the productivity of popular mass science in palaeoanthropology during the Cultural Revolution.

[6] See for example M. Benton et al, 'The remarkable fossils from the Early Cretaceous Jehol Biota of China and how they have changed our knowledge of Mesozoic life,' *Proceedings of the Geologists' Association*, 2008, vol. 119, pp. 209–228 for a summary, and X. Xu, X. Zheng and H. You, 'Exceptional dinosaur fossils show ontogenetic development of early feathers,' *Nature*, 2010, vol. 464, pp. 1338–1341.

[7] The history of twentieth-century palaeontology is relatively underdeveloped, but see E. Buffetaut, *Short History of Vertebrate Palaeontology*, Springer, 1987, and P. Brinkman, *The Second Jurassic Dinosaur Rush: Museums and Palaeontology at the Turn of the*

Twentieth Century, Chicago: University of Chicago Press, 2010. However, work on the late-eighteenth and nineteenth centuries has shown it to be very well-suited to illustrate patterns of exchange and circulation. See for example J. Pimentel, ‘Across Nations and Ages: The Creole Collector and the Many Lives of the Megatherium,’ in S. Schaffer, L. Roberts, K. Raj and J. Delbourgo (eds.), *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820*, Sagamore Beach, MA: Science History Publications, 2009, 321-354 and I. Podgorny, ‘Fossil Dealers, the Practices of Comparative Anatomy and British Diplomacy in Latin America, 1820–1840,’ *The British Journal for the History of Science* 46, 04 (2013): 647–674.

[8] Schmalzer, *People’s Peking Man*, 35-7, and J. P. McCormick and J. Parascandola, ‘Dragon Bones and Drugstores: The Interaction of Pharmacy and Palaeontology in the Search for Early Man in China’ in *Pharmacy in History*, 1981, vol. 23, no. 2, pp. 55-70.

[9] Cited in M. Schlosser, ‘Die fossilen Säugethiere Chinas nebst einer Odontographie der recenten Antilopen,’ in *Abhandlungen der mathematisch-physikalischen Klasse der königlich Bayerischen Akademie der Wissenschaften* 1906, vol. 22, pp. 1-222: p. 14.

[10] For an early history of this idea, see H. F. Augstein, ‘From the land of the Bible ot the Caucasus and beyond: the shifting ideas of the geographical origin of humankind,’ in W. Ernst and B. Harris (eds.), *Race, Science and Medicine, 1700-1960,* New York & London: Routledge, 1999, pp. 58-79.

[11] See in particular Fan, ‘Science and Informal Empire’ and J. Osterhammel, ‘Forschungsreise und Kolonialprogramm: Ferdinand von Richthofen und die Erschließung Chinas im 19. Jahrhundert Zuerst,’ *Archiv für Kulturgeschichte* 69 (1987), 150-195.

[12] Schlosser, 'Die fossilen Säugethiere,' p. 4.

[13] Schlosser, 'Die fossilen Säugethiere,' pp. 5-6.

[14] Schlosser, 'Die fossilen Säugethiere,' pp. 6.

[15] Schlosser, 'Die fossilen Säugethiere,' p. 78.

[16] Schlosser, 'Die fossilen Säugethiere,' p. 220.

[17] Schlosser, 'Die fossilen Säugethiere,' p. 7.

[18] Schlosser, 'Die fossilen Säugethiere,' p. 192.

[19] Schlosser, 'Die fossilen Säugethiere,' pp. 20-1.

[20] Discussed in Shen, *Unearthing the Nation*, especially, 17-71.

[21] C. Y. Hsieh, 'Proceedings of First Annual Meeting of the Geological Society of China,' *Bulletin of the Geological Society of China*, 1923, vol. 2, pp. 1-16: p. 2.

[22] C. Furth, *Ting Wen-Chiang: Science and China's New Culture*, Cambridge, MA: Harvard University Press, 1970, p. 41.

[23] Shen, 'Going with the Flow.'

[24] J. G. Andersson, *Children of the Yellow Earth: Studies in Prehistoric China*, London: K. Paul, Trench, Trubner & co, 1934, pp. 77-82.

[25] H. T. Chang, 'On the History of the Geological Science in China' in *Bulletin of the Geological Society of China* 1922, 1, pp. 4-7: p. 5.

[26] These were described in A. W. Grabau, *The Rhythm of The Ages: Earth History in the Light of the Pulsation and Polar Control Theories*, Huntingdon, NY: Robert E. Krieger Publishing, 1978 and The *World We Live In: A New Interpretation of Earth History*, Taipei: Geological Society of China, 1961.

[27] D. Black, 'Asia and the Dispersal of Primates,' *Bulletin of the Geological Society of China* 1925, vol. 4, pp. 133-184: p. 134.

[28] W. D. Matthew, *Climate and Evolution: Second Edition*, New York: New York Academy of Sciences, 1939.

[29] Black, 'Dispersal of Primates,' p. 141

[30] Black, 'Dispersal of Primates,' p. 143.

[31] Black, 'Dispersal of Primates,' p. 150.

[32] Black, 'Dispersal of Primates,' pp. 155-6.

[33] M. Boule, H. Breuil, E. Licent and P. Teilhard de Chardin, *Le Paléolithique de la Chine*, Paris: Archives de l'Institut de paléontologie humaine 1928, p. i.

[34] Boule, *Le Paléolithique de la Chine*, p. v.

[35] Boule, *Le Paléolithique de la Chine*, p. 94.

[36] R. C. Andrews, *On The Trail of Ancient Man: A Narrative of the Field Work of the Central Asiatic Expeditions*, New York and London: Garden City publishing company, 1926, p. 331.

[37] Andrews, *Trail of Ancient Man*, p. 205.

[38] Andrews, *Trail of Ancient Man*, p. 203.

[39] Osborn in Andrews, *Trail of Ancient Man*, p. 202.

[40] Osborn, 'Arrest of Geologic, Archaeologic and Palaeontologic Work in Central Asia' in *Science* 1931, vol. 74, pp. 139-142: p. 142.

Bibliography

Andersson, J.G., *Children of the Yellow Earth: Studies in Prehistoric China*, London: K. Paul, Trench, Trubner & co, 1934.

Andrews, R.C., *On The Trail of Ancient Man: A Narrative of the Field Work of the Central Asiatic Expeditions*, New York and London: Garden City publishing company, 1926.

Augstein, H.F., 'From the land of the Bible ot the Caucasus and beyond: the shifting ideas of the geographical origin of humankind,' in Ernst W. and Harris, B. (eds.), *Race, Science and Medicine, 1700-1960*, New York & London: Routledge, 1999, pp. 58-79.

Benton, M. et al, 'The remarkable fossils from the Early Cretaceous Jehol Biota of China and how they have changed our knowledge of Mesozoic life,' *Proceedings of the Geologists' Association*, 2008, vol. 119, pp. 209–228.

Black, D., 'Asia and the Dispersal of Primates,' *Bulletin of the Geological Society of China* 1925, vol. 4, pp. 133-184.

Boaz, N.T. and Ciochon, R.L., *Dragon Bone Hill: An Ice-Age Saga of Homo erectus*, Oxford: Oxford University Press, 2004.

Boule, M., Breuil, H., Licent, E. and Teilhard de Chardin, P., *Le Paléolithique de la Chine*, Paris: Archives de l'Institut de paléontologie humaine 1928.

Brinkman, P., *The Second Jurassic Dinosaur Rush: Museums and Palaeontology at the Turn of the Twentieth Century*, Chicago: University of Chicago Press, 2010.

Buffetaut, E., *Short History of Vertebrate Palaeontology*, Springer, 1987

Chang, H.T., 'On the History of the Geological Science in China' in *Bulletin of the Geological Society of China* 1922, 1, pp. 4-7.

Fan, F.T., ‘Circulating Material Objects: The International Controversy Over Antiquities and Fossils in Twentieth-Century China,’ in Lightman, B.V., McOuat, G., and Stewart, L. (eds.), *The Circulation of Knowledge Between Britain, India, and China: The Early-Modern World to the Twentieth Century*, Leiden: Brill (2013), pp. 209-236.

Fan, F.T., ‘Redrawing the Map: Science in Twentieth-Century China,’ *Isis*, 2007, vol. 98, pp. 524-538

Fan, F.T., ‘Science and Informal Empire: Victorian Naturalists in China,’ *British Journal for the History of Science* 36 (2003) pp. 1-26.

Fan, F.T., *British Naturalists in Qing China: Science, Empire, and Cultural Encounter*, Cambridge, MA: Harvard University Press, 2004).

Furth, C., *Ting Wen-Chiang: Science and China’s New Culture*, Cambridge, MA: Harvard University Press, 1970.

Grabau, A., *The Rhythm of The Ages: Earth History in the Light of the Pulsation and Polar Control Theories*, Huntingdon, NY: Robert E. Krieger Publishing, 1978.

Grabau, A., The *World We Live In: A New Interpretation of Earth History*, Taipei: Geological Society of China, 1961.

Howells, W.W. and Tsuchitani, P.J. (eds.), *Palaeoanthropology in the People’s Republic of China: A Trip Report of the American Palaeoanthropology Delegation*, Washington, DC: National Academy of Sciences, 1977.

Hsieh, C.Y., ‘Proceedings of First Annual Meeting of the Geological Society of China,’ *Bulletin of the Geological Society of China*, 1923, vol. 2, pp. 1-16.

Jia, L. and Huang, W., *The Story of Peking Man: From Archaeology to Mystery*, Beijing and Oxford: Oxford University Press, 1990.

Kohler, R. and Kuklick, H. (eds.), *Osiris volume 11: Science in the Field*, University of Chicago Press: Chicago (1996).

Kohler, R., *Landscapes and Labscapes: Exploring the Lab-Field Border in Biology*, Chicago: University of Chicago Press, 2002,

Kuklick, H., 'Personal Equations: Reflections on the History of Fieldwork, with Special Reference to Sociocultural Anthropology,' *Isis* 102, 1 (2011): 1–33.

Matthew, W.D., *Climate and Evolution: Second Edition*, New York: New York Academy of Sciences, 1939.

McCormick, J.P. and Parascandola, J., 'Dragon Bones and Drugstores: The Interaction of Pharmacy and Palaeontology in the Search for Early Man in China' in *Pharmacy in History*, 1981, vol. 23, no. 2, pp. 55-70.

Osborn, H.F. 'Arrest of Geologic, Archeologic and Palaeontologic Work in Central Asia' in *Science* 1931, vol. 74, pp. 139-142.

Osterhammel, J., 'Forschungsreise und Kolonialprogramm: Ferdinand von Richthofen und die Erschließung Chinas im 19. Jahrhundert Zuerst,' *Archiv für Kulturgeschichte* 69 (1987), 150-195.

Pimentel, J., 'Across Nations and Ages: The Creole Collector and the Many Lives of the Megatherium,' in Schaffer S., Roberts L., Raj K. and Delbourgo, J. (eds.), *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820*, Sagamore Beach, MA: Science History Publications, 2009, 321-354 .

Podgorny, I., 'Fossil Dealers, the Practices of Comparative Anatomy and British Diplomacy in Latin America, 1820–1840,' *The British Journal for the History of Science* 46, 04 (2013): 647–674.

Schlosser, M., 'Die fossilen Säugethiere Chinas nebst einer Odontographie der recenten Antilopen,' in *Abhandlungen der mathematisch-physikalischen Klasse der königlich Bayerischen Akademie der Wissenschaften* 1906, vol. 22, pp. 1-222.

Schmalzer, S., *The People's Peking Man: Popular Science and Human Identity in Twentieth-Century China*, Chicago: University of Chicago Press, 2008.

Schneider, L., *Biology and Revolution in Twentieth-Century China*, Lanham, MD: Rowman & Littlefield Publishers, 2003.

Shapiro, H.L., *Peking Man*, London: Touchstone, 1974.

Shen, G., 'Going with the Flow: Chinese Geology, International Scientific Meetings and Knowledge Circulation,' in Lightman, McOuat, and Stewart (eds.), *Circulation of Knowledge*, pp. 237-260.

Shen, G., *Unearthing the Nation: Modern Geology and Nationalism in Republican China*, Chicago: University of Chicago Press, 2014.

Wang, Z., 'Saving China through Science: The Science Society of China, Scientific Nationalism, and Civil Society in Republican China,' *Osiris*, 2002, vol. 17 (2002) pp. 291-322.

Xu, X., Zheng, X. and You, H., 'Exceptional dinosaur fossils show ontogenetic development of early feathers,' *Nature*, 2010, vol. 464, pp. 1338–1341.